Further Notes on MICROSCOPIC CRYSTALS in some of the Gems, &c.

BY ISAAC LEA.

In a paper which I recently read to the Academy, I mentioned having found acicular crystals in *Precious Garnets*. Since then I have had the opportunity of examining a number of cut specimens of *Sapphire* in the forms of *Asteria*, *Catseye*, &c. I have also examined many specimens of *Cinnamon Stone* from Ceylon, brought by Dr. Ruschenberger, of the United States Navy, also, among others, a very fine specimen of bluish *Sapphire*, in the collection of Prof. Leidy.

Having made microscopic drawings of these and other species, having included microscopic crystals, I propose to present them with as nearly correct illustrations as possible.

The whole subject of microscopic mineralogy has been of great interest to me, and I hope these short notes may induce some student to pursue the subject to a greater extent than I have had it in my power to do. It cannot fail that, with the use of the numerous admirable microscopes now made in this country, working with so much more facility than with those we have been accustomed to from abroad, observers may continue to bring to our knowledge much that has been heretefore unknown and very little suspected in this branch of science.

In my former paper I stated the proportional number among *Bohemian Garnets* which I found to contain microscopic crystals. I now propose to give descriptions and figures of the appearance of these crystaline forms, and with this view I have made drawings of their apparent forms under a power of about 100 diameters.

Sapphire. A very remarkably beautiful *Asteriated bluish Sapphire*, procured by Dr. Ruschenberger when in Ceylon, presented to the naked eye the six rays which in the sun were sharp and of great beauty. The specimen being set as a gem of luxury, I could not get a view by transmitted light, but by reflected light, with great care, the exceedingly minute crystals were distinctly seen. They are very short, of pearly lustre, at three different equal angles, thus producing the bands which form the rays in three directions of 60° each. The reflection from the sides of these minute crystals cause, of course, the asterism of six rays over any point of the curved polished surface of the specimen. These rays are formed on the same principal precisely as the asterism in *Phlogopite*, which I have mentioned elsewhere.

Fig. 1 represents the delicate, numerous, minute crystals in the beautiful *Asteria* referred to above belonging to Dr. Ruschenberger. The acicular crystals are so small that it was with great difficulty I obtained their position as here represented.

The variety of *Sapphire* (Corundum) which goes under the name of *Catseye*, has irregular coarse striæ, which have the appearance of being *Asbestus* as is generally supposed. In this gem there is a single band which varies according to the position it may be placed in, and by no means has the beauty of the asteriated *Sapphire.* Several of these are now before me which came from Ceylon.

Fig. 2 represents the crystals which I observed in a fine small bluish *Sapphire*, in Prof. Leidy's fine collection of gems. The cuneiform or arrow-headed crystals are very extraordinary, and they may be simply twin crystals of some substance of which at present we can have no perfect idea. They remind us in their form of *Selenite* crystals, such as are found in the Paris Basin, and at once we recognise the similarity to the cuneiform character stamped on the bricks of Babylon, and cut in the alabaster monuments of Nineveh. The group which I have drawn represents six of these cuneiform crystals, and six acicular crystals. Of the former six, four had a bluish tinge and two were pinkish. The acicular crystals were disposed to take three different directions, parallel

to the primatic hexagon sides of *Corundum*. Both sets of these crystals are enlarged to about 200 diameters, for the purpose of giving distinctly their very singular form.

Specimens of *Garnet* examined from all localities obtainable, presented very different aspects. When crystals were found in them they always proved to be acicular in form, but by no means similarly regular or of the same length, direction, or of the same size.

Fig. 3. A Bohemian cut *Garnet* presented three sets of numerous, thickly set, parallel, acicular *crystals*, which crossed at an angle of 120°, forming a very regular lattice-work appearance.

Fig. 4. A Bohemian cut *Garnet* presented only two sets of acicular crystals, which were usually at right angles, but some were inclined from perpendicularity and they were not so long as those of figure 3.

Fig. 5. A Bohemian cut *Garnet* presented a very different set of crystals. They were generally short, comparatively, and pointed in every possible direction.

Fig. 6. *Garnet* from Ceylon—*Cinnamon-stone*—fractured portions, not cut and polished. The acicular crystals were much shorter, rather thicker and much more bluntly terminated than in Fig. 5. They are placed at all angles. Ten specimens only in 80 examined had any thing like crystals, while all had irregular rifts or cavities within.

Fig. 7. *Precious Garnet = Pyrope?* from Green's Mill, Delaware Co., Penn., presented acicular crystals somewhat like Bohemian Garnet, fig. 3, but the three sets, while they take the same three directions, are shorter and left interspaces as shown in the figure.

Fig. 8. *Garnet* from North Carolina. A thin fracture from a compact garnet of large size, perhaps two inches in diameter. The acicular crystals are not very numerous—they are thin and not continuous. Connected with these are a few dark crystals. These take no particular direction like the others, but seem to be interspersed throughout.

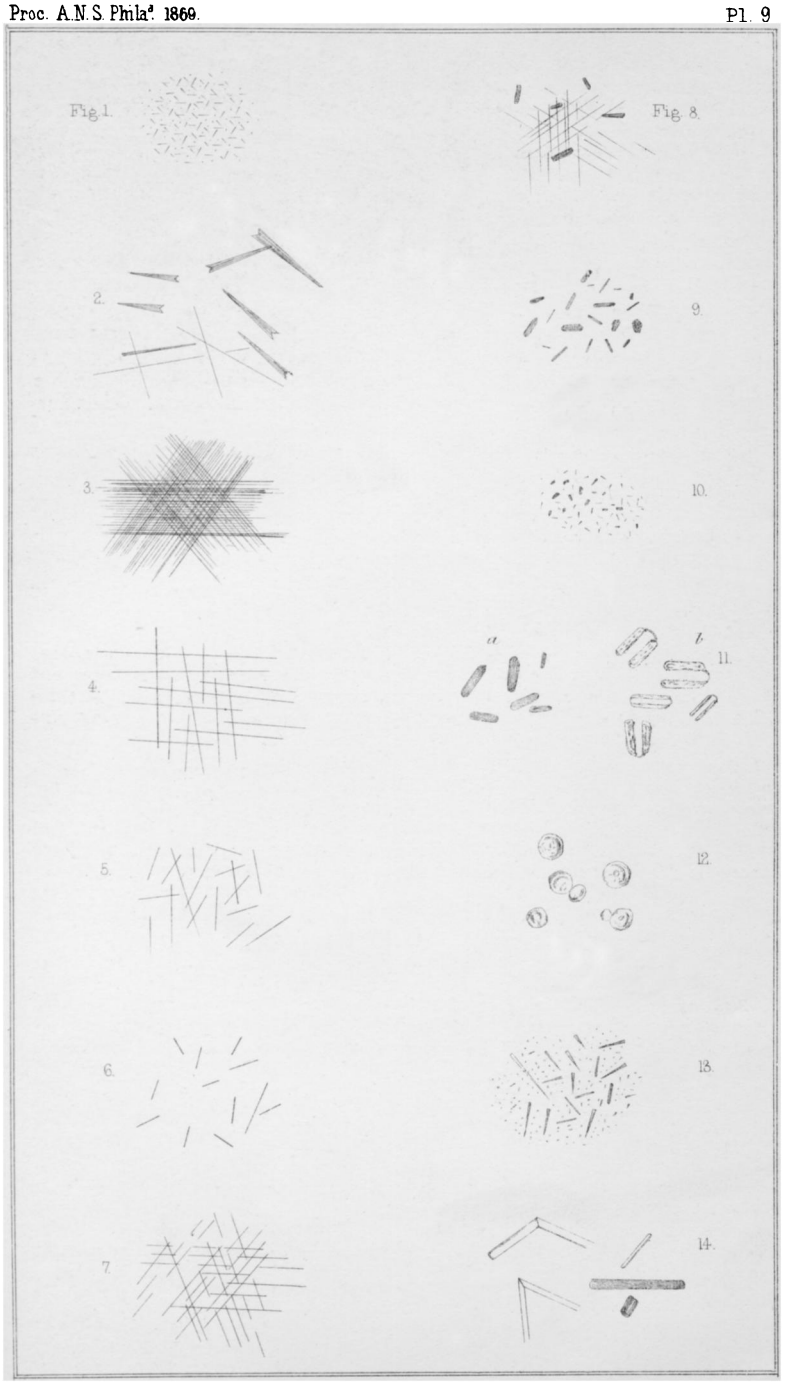
Fig. 9. *Labradorite.* This specimen is a small polished one from Ceylon, and belongs to Dr. Ruschenberger. Besides the usual play of pavonine colors in *Labradorite*, I have found in all the specimens I have examined from various other localities, very minute reflecting crystals like those in *Sunstone*, and which are no doubt the same, but differing in size, being smaller so far as I have observed. The microscopic forms as figured will be observed to consist of two sets apparently distinct. The larger are rather irregular and black. The thinner are rather shorter and more delicate. These are not the reflection of the plates of *Göthite*,* they are the black crystals which are usually in dark *Feldspar*.

Fig. 10. *Black Feldspar.* A small specimen of black *Feldspar*, translucent in thin pieces, from Chester Co., Penn., presented quite a different appearance from *Labradorite* in its minute, black included crystals. They are very numerous, very short, opake black, and irregular in form. They are closely set and irregular in their direction. There were no reflections from any of these included crystals.

Fig. 11. *Barite*, from Antwerp, Jefferson Co., New York. *a* represents some opake crystals observed in a small prismatic crystal. They cannot be, I think, rifts, and yet they are evidently without planes. *b* represents singular impressions on the surface of one of the prismatic planes, and their singular form, like the common horse-shoe magnet, induces me to call attention to them.

Fig. 12. *Amethyst.* A specimen from Thunder Bay, Lake Superior, presents very remarkable globules, some of an orange-yellow and some of a dark-green. These are very visible to the naked eye, and in the figure they are not

* The plates of Göthite when held at a proper angle may easily be seen by the naked eye.



MICROSCOPIC CRYSTALS IN GEMS.

very greatly magnified. They vary somewhat in size, and the orange-colored ones are most numerous in the specimen before me. There is a cloudiness in these yellow globules and a few are not completely spherical, presenting a cup-shaped form. To the naked eye the green globules appear to be black, but under the microscope they are evidently dark green. The composition of the two sets are no doubt the same, and the color probably depends on their being in a different state of oxidation. In a few cases I observed the two colors in the same globule. In another specimen from the same locality I found the globules to be much smaller and the green ones to prevail.*

Fig. 13. An *Asteriated Sapphire*, also belonging to Dr. Le Conte, of an obtuse conical form, and of unusual beauty, presented very remarkable microscopic crystals of a white silken hue. The larger of two sets were generally, though not always, cuneate and lay in three directions, differing somewhat in size. In the smaller set the crystals are very minute, having the same pure white, silken appearance. These fill up the interstices of the larger crystals.

A Sapphire of large size and peculiar beauty, in the possession of Dr. Le Conte, presented a few distant, white silk-like lines, running in one direction, and parallel to each other. It is of unusual brilliancy and fine color and is thirteen-twentieths by eleven-twentieths of an inch in size.

Fig. 14. A *Pyrope* from New Mexico, in which the microscopic crystals differ from any of the many *Garnets* I have examined. In other specimens from this locality—of which I have examined twenty in the collections of Prof. Frazer and Dr. Le Conte—acicular crystals alone were found. In this specimen the crystals are much larger, less in number and of an entirely different character. Some are geniculate and transparent, while some are dark or semi-transparent. A very short and rather thick crystal seems to present three sides of an hexagonal prism. These New Mexican *Pyropes* are of uncommon beauty and perfection. This specimen is in the collection of Prof. Frazer. His other seven specimens have acicular crystals. Of Dr. Le Conte's twelve specimens, six had acicular crystals, and six presented no appearance of inclusions. When the acicular crystals are examined in the direct rays of the sun at right angles to their axis, they reflect all the spectral colors in a very beautiful manner.

A small brilliant *Ruby*, which has the appearance of being oriental, but which may be a *Spinel Ruby*, was found to be very full of long acicular crystals which were observed to be in all directions, and were to all appearances the same as observed in *Precious Garnets*. A larger specimen has the same kind of acicular crystals, but in this specimen these crystals take generally two directions and are oblique to each other.

Two out of four other very beautiful small *Oriental Rubies* = *Sapphire* were found to have very minute acicular crystals. In one of them these crystals were in three directions; in the other they were in two directions. Both these gave that peculiar changable band observed in the "Catseye" Sapphires. All these rubies were cut as brilliants and were of great beauty.

It is apparent that the microscopic crystals in the various minerals above described, cannot all be of the same substance. Their forms and appearance forbid that, and chemical analysis will never probably reach, with any degree of satisfaction, their ultimate constituents. Spectral analysis may, however, be able to give us some results when properly applied, which may in some measure satisfy us in regard to the composition of these interesting included microscopic crystals.

Sexual Law in the CONIFERÆ.

BY THOMAS MEEHAN.

In some various papers last year before this and other bodies, I was able to prove, I believe, to the satisfaction of my fellow botanists, that the true leaves

* The Amethysts of Chester County, Penna., very frequently have minute acicular crystals of *Rutile*.